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MY AQUARIUM.

BY H. B. SMALL.

(Read March 2nd, 1893.)

In a work that I published on "The Fresh Water Fish of Canada," I quoted on the title page, the following passage from W. Scrope, a writer in the early part of the century, where he says:—"I like the society of fish, and as they cannot with any convenience to themselves visit me on dry land, it becomes me in a point of courtesy to pay my respects to them in their native element." Quaintly as he expressed it, it forshadowed the study of their habits. Now Nature opposes certain obvious obstacles to the pursuit of knowledge in the water, which renders it difficult for the ardent naturalist, however much he may be so disposed, to carry on his observations with the same facility as in the case of birds and mammals. Still by observation here, and experiment there, watching through a sheet of plate glass, naturalists manage to piece together a considerable mass of curious and interesting information of an out of the way sort, about the domestic habits and manners of sundry members of the finny tribe. To the eye of the mere casual observer, every fish would seem at first sight to be a mere fish, and to differ but little from all the rest of his kind. But when one comes to look closer into their ways, one finds fish are in reality as various and as variable in their modes of life, as any other great group in the animal kingdom. Concealed under stones in babbling brooks, hiding in the grassy margin of purling streams, buried in the depths of silent ponds, roaming in the submerged forests of aquatic vegetation, is a multiplicity of animal life that may profitably be made a study, and to thoroughly explain which would require a lifetime.

In 1850, Mr. Robert Warrington addressed to the Chemical Society of London, a series of observations on the fact announced by Ingraham in 1778, that plants immersed in water when exposed to the action of light, emit oxygen, and the consequent necessity of their presence for the preservation of animal life. He reported placing two small gold-fish in a glass, having first planted in sand and earth at the bottom, a small plant of *Valisneria*. The latter, as the leaves decayed,

fouled the water, and to remedy this he tried the introduction of a few snails, which, feeding on decaying matter, quickly restored purity and clearness to the water. In 1852, he experimented with sea-water and its occupants, with equal success. To Mr. Gosse, however, the well-known naturalist, may be attributed the popularity of the Aquarium which is certainly the purest of all household recreations. His first work on the subject, somewhere about the year 1855, was read with avidity, and although the London "Punch" levelled its keenest wit and satire against the new mania, and pointed to all the mishaps which might befall housekeepers by the breaking of the Aquarium and the consequent deluging of carpets, the passion for aquaria grew, and in 1857 they may be said to have been formally established in England. In that year, one of the quarterly Reviews remarked that the making and stocking of these had created a new and important branch in commercial industry. In 1856, Barnum introduced into New York the first of what he styled—"Ocean and River Gardens," and a few months afterwards they were for sale of all sorts and sizes, for private use. Before that, the glass globe for gold-fish was the only representative of the new apparatus. In keeping an Aquarium, very little is wanted besides the tank itself. It is well to have an india-rubber tube or a syphon for drawing off the water when necessary; a wooden forceps for removing any object, and a sponge stick for cleaning the glass, together with a small fine-meshed hand net for handling any of the inmates if need be.

Some years ago, when residing in New York State, I was attached to one of the Military Colleges affiliated with West Point; and one of the first things that I did to engage the interests of the Cadets under my charge, was to turn their minds, during leisure hours, to the study of Natural History.

As I was at that time making collections of all kinds, I enlisted them in the work of procuring specimens, and I organized, on our Saturday holiday, field parties among the woods and mountains in the vicinity of the College, along the Hudson River. This was just at the time when Aquaria were in vogue, and I took advantage of the first visit that I paid to New York, to purchase an Aquarium for my own private use, which I kept in my quarters, open to the inspection of all

who wished to see it. This was over thirty years ago, and that I still have the Aquarium in almost as good condition as when I purchased it, is, I think, sufficient evidence that it was well adapted for its purpose. It is a comparatively small one, being only fifteen by nine inches. I think I may say it has done its full share in the way of attracting attention to "Life below the water." The first great difficulty I had to contend with was the multiplicity of objects that were brought to me for it by my cadets.

You would be astonished if I were to give you all the varied suggestions that were made respecting what should constitute the floor of the tank, some recommending small pebbles, others, gravel or sand, till finally a compromise was effected to the satisfaction of all, by giving each of the proposed materials its own place. Experience afterwards showed that a little clean river sand is the safest ground work for all purposes. Then there was the natural inquisitiveness of boyhood to combat. Whilst the novelty was at its height, the inmates were subjected to all sorts of ordeals, such as poking up with a stick, to see if they were lively; and a continual desire was evinced to handle them. Over-feeding was one of the most trying evils to contend against, for the superfluity of bread and meat supplied, in all good intent, for the use of the inmates, had a tendency to sour and discolor the water, and to create, when overdoses were administered, a fermentation by no means conducive to vitality. However, for the sake of encouraging research and creating amongst the cadets an interest in my Aquarium, I would naturally put up with all these little inconveniences, removing as soon as possible when left to myself, all extraneous matters from the water, and by frequent use of the siphon withdrawing the disturbed contents to be replaced with fresh, healthy, spring water. In a very little time the Aquarium ceased to be a wonder and became an object of interest, and so my point was gained.

I well remember its first inmate, which was the larva of a Dragon-fly, the various stages of whose subaqueous life were of continual interest, and great was the astonishment one day, when only an empty case was found attached to the stalk of the water weeds, its inmate having taken to itself wings and disappeared. The locality afforded a splendid field for collecting, as the Croton River emptied into the Hudson within a

mile or two of the College. Rockland Lake and Haverstraw Bay were on the opposite shore, whilst in the hills back of us were numerous ponds and streams abounding with life. Near the mouth of the Croton River lay the old Van Cortland Manor House, on the lawn of which was a fish-pond, constructed by some of the early Dutch occupants and well stocked with gold-fish. During a heavy freshet one spring, some years previous to the time I am talking of, the banks of this pond gave way, discharging its waters and its contents into the Croton River. As a consequence of this, the gold-fish took up their quarters in the Croton and Hudson Rivers, and it was no unusual thing when the fisherman were drawing their seines in this vicinity, for a number of gold-fish to be among the fish taken. These were generally thrown back, but anyone on hand at the time could always procure what he wanted and I, at various times, picked out such as I chose. These fish had also from time to time been taken by boys to various ponds in the hills, so that there is no lack of gold-fish in the waters of West Chester County. I may here mention, that further up the Hudson River a similiar fish-pond years ago gave way, well stocked with the European Carp that had been brought from Holland. These have also taken to the Hudson River and are from time to time netted there. Being of the same family, they have crossed with the gold-fish in breeding, and the result is that a mottled fish is frequently to be seen, some of which bear very little of the distinctive red that marks the gold-fish proper. I have seen the latter in the lagoons along the railway in that vicinity, eight or nine inches long, and although it may be seem scarcely credible, I have seen them lying in shoals near the surface of the water on a bright sunny day, in such abundance that the surface appeared to assume where they were, a red tinge.

The Hudson River is famous for its eels, and small specimens of these were occasionally brought to me. A scoop-net, drawn through the liquid mud in any of the tide-water pools along the river margin generally brought up more or less small eels, so that a good selection could be made of the size best adapted for observation. From the experience I gained with them, I would never recommend more than one small eel being placed in an aquarium, as two which I first introduced took up their respective quarters at either end of the tank, and

were perpetually doing battle like knights of old, charging on each other most furiously, with the final result one morning of my finding both dead on the surface of the water, one of them having half swallowed the other, but the latter in the operation choked his conqueror, with the result mentioned. A subsequent specimen of mine was in the habit of secreting himself between two stones, with part of his body only exposed, as if watching everything. There is apparently much of the snake in their habits, and the same timidity exists in each. The least noise disturbs their equanimity and thunder seemed particularly to affect my specimen. Although he occasionally moved round in the daytime, night was the time for his activity, and the artificial light of a room seemed in no way to interfere with his apparent recognition of time. One eel at a time affords ample opportunities for studying the habits of that family.

One of the most interesting fish to watch, is the cat-fish, which I am seldom without, but it must be kept well fed, and even then the fins and tails of other fish bear evidence of its attacks upon them. It is astonishing what an amount of food a cat-fish will swallow. You can watch his stomach swelling out to such an extent that it presents the appearance of a fowl's crop when fed to repletion. After he has thoroughly bloated himself out, he generally settles down, under or beside a stone, and lies there in a sort of comatose state for some time, closely resembling in this the serpent family. As soon as the effects of his meal has passed off, he becomes one of the most restless of the occupants of the aquarium, and swims backward and forward and up and down, incessantly, as if calling attention to his wants. I have not the slightest doubt that, after a time, fish know intuitively to a certain extent, when feeding time comes and the party that feeds them. I think the cat-fish are affected by, and feel coming changes of weather, but one cannot deduce conclusions from observations taken in a room where the temperature is probably uniform, as compared with the natural temperature out of doors.

Sticklebacks I have had in abundance, but more than two at a time become a nuisance. It is a perpetual warfare all round, especially if the males predominate. They, together with sun-fish, are, probably the most pugnacious of all fish, showing hostility even to my finger when

held towards them under water, their fins and spines bristling up like the hairs on a bull-dog's neck, when excited. They snap at everything, and it is impossible to keep any larvæ in an aquarium any length of time if these fish are joint occupants. I have read of sticklebacks building their nests and breeding among the weeds in an aquarium, but I never witnessed any operation of this kind myself, as I frequently changed my tenants for the sake of watching the habits of the different kinds of fish from time to time brought to me, with the exception of the gold-fish, which I have always retained.

Bass, I find to be for the most part, nocturnal in their habits, lying comparatively still the greater part of the day. Like the sun-fish, they are very tenacious of the spot they select, which they occasionally sail quietly round and round as if guarding, and woe to the unwary fish who may venture to settle down in the quarters they have chosen. The small brook sucker, I have kept and watched with a great deal of interest. They are useful scavengers, cleaning up, by suction, everything they come in contact with at the bottom, rolling it over their palate, swallowing whatever suits their taste, and thus disposing of a good deal of refuse matter which otherwise gives considerable trouble in getting rid of. These fish are, however, of what I might style, too delicate a constitution to be recommended as permanent occupants. Accustomed as they are to running water, and evidently given to roaming in streams, they seemed to suffer when pent up in a small space and except for temporary observation, I would not recommend their introduction into any private aquarium. Crayfish, in the same way, are very unsatisfactory occupants, and I never was able to keep one alive for any length of time.

One of the most interesting fish that I ever had in my aquarium was a small gar-pike, which was caught in a scoop net at the foot of the locks here in Ottawa and brought to me. This fish lived for several weeks, and after his death I placed him in spirits, where he still exists. He was most unsociable, turning his back upon all other fish that approached him, accepting the apparent overtures of none. The only surviving remnant of the fossil bony-scaled Ganoids of the Devonian rocks and belonging to the Mesozoic period, his pedigree probably caused him to look down on the finny tribe of the present age as his

inferiors. Hugh Miller, speaking of the living representatives of these fossil fish, says :—"They seem to have been spared amid the wreck of genera and species to serve as a key by which to unlock the marvels of ichthyology of those remote periods of geological history appropriated to the dynasty of fish." I am inclined to think that my specimen scorned the ordinary food of the other fish, and died from inanition, as I never could induce him, while I was watching, to approach while they were feeding, and if he did satisfy himself at all, it must have been under cover of darkness. However, as he did not appear emaciated at his death, he may have subsisted on animalculæ in the fresh water from time to time supplied. The ordinary pike and dorée I never attempted to keep, and it is almost needless for me to say that brook trout will not live in any ordinary aquarium. The "Shiner" is also too delicate for general keeping and requires highly aerated water.

I have had almost all kinds of small fry, known as "minnows," in my aquarium, consisting of young chub, dace and minnows. They are very lively and become in a short time accustomed to their confined quarters, but from their delicate formation I would never recommend them as permanent inmates. There is one exception, however; that is the barred, or black minnow, which is very hardy and a very amusing fish to watch. Sometimes motionless on the bottom, as if wrapped in deep meditation; at other times balancing himself in the water, he keeps up a continual flapping of his ventral fins, working them like a fly-wheel, with apparently no other object than exercise. At other times, he darts about from side to side, and if more than one of these minnows are occupants they seem to exchange ideas, as the rest of his own species sail about conjointly with him.

Moving about, as I have done, from place to place, my Aquarium occupying the safest place in my baggage and being the first thing attended to after unpacking, I have had opportunities of stocking it from various waters, and when I went to reside for a short time at Buckingham I obtained one day, when fishing in a little trout stream, back of the village, a small specimen of the Bull-head, one of the very few that I have ever taken. He was carefully consigned to my Aquarium but only lived a few days, owing probably, to his transfer from the clear, crystal waters of that running stream to the narrow compass of

still water, to which he was unaccustomed. He lay all the time ensconced between two small stones, hiding himself as closely as possible from observation, refusing food, and evidently sulking as wild animals no when first placed in confinement. The enormous size of his mouth as compared with his other dimensions, gave evidence of the capacity of these fish for disposing of a large meal at a time, but I never had the satisfaction of witnessing the operation of feeding, and I fancy from the retiring habits of the "bull-head" family, very little is really known about them.

Now leaving fish, I must dwell for a minute or two, on the amphibious denizens of the Aquarium. The Water Newt, Eft, and Triton, family known as Lizards, although as repulsive as snakes to some people, afford much interest and amusement. I must confess I have never been fond of them, as I have a great aversion, inborn I suppose, to both lizards and snakes, but I have had Tritons in my Aquarium, as the cadets I spoke of, frequently brought them to me. The Triton is by no means shy, and is really grotesque in his movements, lying sometimes midway between the bottom and the surface, with all his legs spread out at right angles. At other times he suspends himself in the water, moving his feet up and down as a bather treads water, then darting frantically about with great rapidity. Occasionally he sits erect on the bottom of the aquarium, on his hind legs with his fore paws bent forward, like a dog begging. This position the Triton will keep for some time. He is also fond of resting on any portion of rock projecting out of the water, but if he can by any possibility climb to the edge of the aquarium, that is the last of him, as he is evidently of a roving disposition, and in search of the nearest road to liberty he is very apt to be crushed out of existence under foot.

The Tadpoles that were brought to me in every stage of growth were, as the auctioneer says: "Too numerous to mention." I occasionally, to please the bringer, kept one or two for a short time, or till such period as their tails dropped off, at which stage of their existence, if I had not treated them myself to freedom, they would have gained it for themselves, as a frog in the state of maturity can only be kept in bounds by a fine wire grating laid over the aquarium, without which it is futile to keep them for observation. The tadpole, owing to the imperfection

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of its gills has to frequently rise to the surface with a rapid zig-zag motion, something like an unsteady kite in the air. The process of change in these animals is very curious. The hind legs are the first to appear, and there is an interval, ranging from one to three weeks, before the fore legs push through the skin. Then the metamorphosis is rapid, the tail is absorbed and the final state of frog-hood is reached.

Among the respective inmates of the Aquarium, which were brought to me, was a small Turtle, about the size of a silver dollar, for whose benefit a small fragment of rock, projecting a little above the surface of the water, was provided, on which this animal delighted to sun himself whenever there was a chance, but at the slamming of a door, or even at the vibration caused by walking across the floor he would immediately slide off the rock, and swim violently about for a few minutes. He was not one of the "snapping" order, but black, with red marks on the under part of his shell. Turtles seem to be very susceptible to sound and, apart from noticing ordinary noises as above mentioned, he had a habit of constantly turning his head from side to side as if listening. He was very ravenous, the food I gave him consisting of earth worms, and small pieces of raw meat. These he would hold with his fore paws while he pulled at them and occasionally shook them, much in the same way as a terrier does a rat. His end was like that of all pets. He contrived one night to creep out of the aquarium, got on the floor and was crushed by the heavy tread of a human foot.

Another inmate, whose movements I watched with great interest, was a leech; not one of the kind used by doctors, but that known as a "horse-leech." The movements of this creature were very interesting. Fastening himself on the side of the glass, he would swing his body backwards and forwards, elongating and contracting it by turns, in every direction, as if looking out for something, and when finally satisfied that there was nothing within reach, he would slide himself along the glass the length of his body when extended, and then again go through the same proceeding. I would not, however, recommend the introduction of leeches into ordinary aquaria, as the fish therein are sure to suffer from their attacks. These, however, seem to be made under cover of darkness, for I never saw my leech attack any

of my fish, though the death of some of them while he was an inmate, I attributed to his work.

A very interesting class of occupants are the so-called Fresh Water Snails, among which I have always preferred *Planorbis*, whose shell reminds one of the fossil ammonite, *Paludina*, or marsh agate shell, *Limnæa*, and *Physa*. These are all and each a study in themselves. Seen only in their native state they would seem to possess few points of attraction, but when under observation they are very different. The species of *Physa* and *Limnæa* have a curious habit of floating on the surface with shell downwards, propelling themselves by a wavy motion of the wing-like apparatus that encircles their body. They all multiply rapidly, attaching their eggs by a transparent substance to the glass, or to stems of plants, but the voracity of their co-occupants,—fish—seldom allows them to come to maturity, so that there is an alarming table of infant mortality amongst these shell-fish. The utility of these as agents in keeping down the green growth of *confervæ* in an aquarium is great and the way in which they clean the glass is most interesting. The occupant of the shell puts forth his proboscis, turning it apparently inside out as we do a stocking, until the silky surface, which is the tongue, comes in contact with the glass. It then makes a sweep, like a mower's scythe, taking up into a swath all the *confervæ* on that spot. The proboscis enfolds this, and the tongue takes upon it all the vegetation which it has collected and disappears in the animal's interior. A forward movement is then made and another portion of the glass is swept clean by the same process, so that the track of the snails upon the glass may be traced as distinctly as that of a mower, by his swath along a meadow. Although I have had what are known as "fresh-water clams," that is the *Unios* and the *Anodons*, as occupants, they are unsatisfactory, and if a person wishes to study their habits, I think they ought to have a receptacle for themselves. They require a muddy bottom in which to move, and their habits are so distinct and different from those of everything else that they would need segregation from other occupants.

Water Beetles are another interesting branch of life under water, but the larger ones are too voracious to be kept any length of time. I introduced the large Horny-cased, Black Water-Beetles (species of

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Dytiscus), into my aquarium several times, but I found that they were given to roam by night; rising to the surface they would unfold the gauzy wings encased under the horny covering and take flight from the water, and would be found next morning somewhere about the room if there was no outlet, or attention would be called to their escape, from their flying about the room like a small bat. I may state here that it is not unusual to find these insects on our sidewalks at the foot of an electric light pole, to which they seem attracted by the glare. There is another Beetle (a species of *Acilius*) with a bronze casing, which is an interesting object, from its rapid motion and apparent game of hide and seek from stone to stone.

A few years ago, a specimen of *Menobanchus*, that curious batrachian with gills and breathing tubes protruding therefrom, was offered to me by a boy who had caught it whilst fishing in our Rideau Canal. Repulsive looking as these creatures are, I would have liked to have studied his habits, but the reptile had been so bruised that it was too far gone to make use of, and I have never since had an opportunity of obtaining one. These animals are numerous in the waters of the Ottawa, and are not unfrequently taken by persons bait-fishing. I have seen specimens in one or two windows in town here, but the pent up waters of an aquarium seem scarcely healthy enough for them, as I noticed their place was very soon empty.

I believe that it remains an open question as to what senses are possessed by Fish, apart from that of sight. There is every reason to believe that they possess the faculty of smell, for it is no uncommon thing when fishing to notice their manner of swimming round and about the bait that is used, bringing their heads in contact with it, even pushing it, which to my mind is evidence of their using their olfactory organs to help them thereby to ascertain the quality of the bait. Again, many fishermen use oil of aniseed and other essences on their bait, which they affirm have the property of attracting fish, and I myself have many a time noticed a fish after dallying with the apparently tempting looking bait and moving it with its snout, finally turn away as if in disgust. Sir Humphry Davy says he thinks the principal use of nostrils in fish is to assist the propulsion of water through their gills, but he thinks also there are some nerves in these organs which give a sense of the qualities of

the water or of substances dissolved in, or diffused through it, similiar to our sense of smell.

With regard to hearing, it is very difficult to arrive at any conclusion, for what may be attributed in them to the sense of hearing is, in most cases, if not all, attributable to vibration. A sudden slam of the door, a clap of thunder, or a stamping on the floor will start into violent movement a fish lying perfectly still. I remember as a boy, standing by a fish pond, belonging to my father, (at which, by the way, before the days of aquaria, I picked up a good deal of knowledge on the habits of fish,) watching a shoal of roach sunning themselves on the surface. A dark cloud was speedily approaching, from which suddenly burst out a bright flash of lightning without in the least disconcerting the fish, but the instant the thunder sounded, they dissappeared with a dive downwards, scattering in all directions, and I am very much inclined to the opinion that it is vibration or percussion alone that supplies to them what with us we attribute to hearing. Those who had the pleasure of listening to Dr. Powell's recent lecture on "Sound", will remember that his explanation of hearing was, that it is to a great extent, based on sound vibrations conveyed through our organs of hearing, to the brain.

The vision of Fish is peculiarly acute. This is known to all fishermen, who, on a sunshiny day carefully avoid letting their shadow, or even the shadow of their rod fall upon the water. I have seen trout dart from cover to seize a bait floating midway down the stream and before they had reached it suddenly turn back, deterred from their object, either by a shadow cast on the water, or by a sight of a man on the bank. When a strange fish is put into an aquarium, he at first avoids showing himself in the open when an observer is by, but when he becomes accustomed to frequent visits he seems to have no objection to a stranger and swims about unconcernedly.

Fish exhibit an inquisitive turn of mind. If a new pebble is dropped into an aquarium they watch it from a distance, evidently with great curiosity. After a while they will swim around it at a respectable distance, till one of them, bolder than the others, makes a dash at it, immediately rejoining his fellows. Then one or two will swim round and round it, gradually approaching nearer to it, till finally they come in contact with it and, when satisfied that it is an object of no harm,

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they then pass and repass it without any further apparent notice. Again when fresh plants are placed in an aquarium, they will swim in and out of them in every direction as if to satisfy themselves that they are really plants. Another curious thing that I have noticed is that, when fresh clean sand is deposited in one spot, they are very fond of balancing themselves over it in an almost perpendicular position, drawing in, by suction, a mouthful of it, which they convey to another spot and there deposit it, carrying on this operation till quite a quantity of the sand has been removed. This apparently curious habit I attribute to their propensity for preparing in their natural condition, a fitting repository for their spawn.

Whether Fish have taste or not, is I think past our comprehension but I am inclined to the idea that they have for we all know that when one bait fails to attract, another will often prove attractive, and the only reason one can naturally assign for that is that it is one more suited to their taste.

I should like to say something about the diseases to which Fish, pent up in aquaria seem subject, but although I have suffered from time to time by apparent epidemics, I am not able to pronounce any deductions from these losses. Only this winter I record the loss, one after another, of some 12 or 14 minnows which I obtained in October last, and which remained thoroughly strong and lively till the early part of January, when they commenced to sicken and die two or three a day till the whole disappeared. The water was regularly changed and they properly fed, but some evident epidemic had taken possession of the shoal, as happens among the human race. The symptoms were an apparent enlargement of the head, with protrusion of the gills, and loss of color in the tail end of the body. The air bladder was evidently affected as they first kept on the surface, then lost their power of balancing themselves and within twenty-four hours, died. Two small minnows which have occupied the aquarium since the previous winter escaped, and are still alive.

I have noticed that in a majority of the deaths amongst my Goldfish, a peculiar fungus-like growth covers the gills, sometimes both, sometimes only one gill. This seems to come on in the last stages as it does not show when they first sicken. The early symptoms are violent restless-

ness, darting to and fro, even knocking their heads against the glass as if delirious ; then loss of balance, the air bladder loses its power and the victim lies on its side with the tail bent downwards as if contracted by spasm, sometimes for two or three days. I have tried everything ; change into warm water ; change into very cold water, and I once tried the effects of bread crumbs soaked in wine (a remedy used in Germany to revive carp when transported for long distances) but all to no effect and I have now come to the conclusion that man cannot prescribe for the denizens of the water, the conditions of life being with them so utterly different from other animal life. The apparent attack of an epidemic amongst fish, which is known to take place in their natural habitats, is only part of that law of nature which subjects life of every description to attacks upon it.

Goldfish are naturally long lived and I have had specimens for ten years at a time, in perfect health. The limited space of an aquarium seems to dwarf their growth and size, as they certainly do not attain to their full proportions half as rapidly as in open waters. Catfish, when grown too large for their quarters, I have frequently taken to the nearest stream and they swim off as unconcerned as if always accustomed to liberty. An aquarium owner soon comes to regard its inmates like all other pets, and it may be said in their favour that they do not require anything like the attendance needed for other living pets. The loss of them is in certain cases more difficult to replace as you cannot always obtain, at the time, a specimen of the kind perhaps most wanted.

There has been great discussion as to the best aspect in which to place an Aquarium, and opinions are varied, but the conclusion I have arrived at is, that a northern aspect is desirable, a southern aspect is worst, and the western nearly as bad, as the sunlight falling on it materially assists the green coating caused by the growth of *confervæ* on the glass. The bottom, which ought to be, if possible, of slate, should be covered with small pebbles or fine gravel about an inch in depth, leaving a small patch for clean sand. Earth is not required, as water plants mostly grow floating. A few pretty stones or a little rock-work should be added with a part of the latter projecting above the water for the purposes already alluded to, especially if fish only are to be kept, as the latter delight in loitering in the friendly shade of a rock. Besides the pleasing appear-

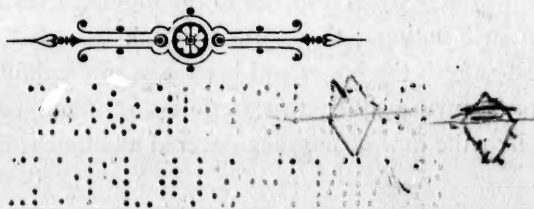
ance afforded by water plants, the purpose of vegetation is to decompose the carbonic acid gas thrown off by animals, the carbon being absorbed into the substance of plants, and the oxygen set free for animal life. Even a growth of *confervæ*, unsightly as it is, is conducive to this. In a large Aquarium, a lily may be introduced, planted in a shell or small pot, hidden by weeds, but any plant that grows above the water is apt to aid any creeping animal to effect his escape. The whorled millfoil is one of the best plants for general use as it prefers still water, and I have succeeded, by inserting it late in the fall, in keeping it through the winter in sufficient quantity to answer all purposes. The goldfish and others of the Carp family, nibble at it, and it is probably as essential to their welfare as vegetables are to man. *Valisneria* is a clean, sightly plant and answers well as an air provider, besides being one of the few plants which afford a microscopic view of the circulation of the sap in the leaves

There is a pleasure in connection with keeping an Aquarium, that to a lover of Nature, adds materially to the charm that attends the observation of its inmates, and that is the rambles made to collect various specimens of aquatic life. The keen lookout for water snails amongst the vegetable growth at the bottom or on the surface of some stagnant pool, and the eagerness to get the little scoop net over one, perhaps just out of reach, affords a pleasure, equal to, if not surpassing that felt by the sportsman beating the bush for game, or the fisherman eagerly watching his bait. The health-giving stroll along the bank of some tiny streamlet, on the lookout for minnows or larvae or any of the varied inmates of its waters, is far different from the monotonous constitutional, along the dusty highway, of the man who has never read a page out of Nature's book of life. The most important principle, perhaps, in life, is to have a pursuit, a useful one if possible, and at all events an innocent one. The scenes you enjoy, the contemplation to which they lead and the exercise attendant on specimen collecting are salutary to the body as they are to the mind. I always find a peculiar effect in such outings; they carry me back to early times and feelings, and create afresh the hopes and happiness of youthful days. Could we all recover anything like that freshness of mind possessed in youth, which, like the dew of morning covered all objects, and in which they

were more beautiful than even in midday sunshine, what would we not give? Rambles with an object go far to bring back the spring of early life.

In conclusion, I will quote the words of Sidney Hibbard, in an Article on the subject of this evening. He says :—

“The Aquarium introduces us to new scenes, hitherto hidden from our view, and makes us acquainted with the economy of creatures of whose very existence, many of us, not altogether unlearned in the history of the world, were previously ignorant. Their habits of feeding, moving, and burrowing, their battles, their change of form, the display of even a strange intelligence working its way by wonderful means to wonderful ends, impress the observer with the idea of the boundlessness, the variety, the adaptations and resources of a world brimming with life, in all manner of strange forms and developments. Here we see them equipped and armed for battle against each other, the strong destroying the weak, yet each contributing its part to the preservation of the whole, just as in all other departments of Nature, the great balance of perfection is sustained by incessant and intestine war; the struggles of opposing elements and powers and beings, all working mysteriously in a manner independent of isolated circumstances, Nature, the prodigal mother, setting no value upon individuals, but regarding tribes and races as paramount, the whole seeming confusion tending to one end; the revolution of the mighty wheel on which the creatures are painted as signs in which ages are but minutes in a revolution which itself is eternity. In the midst of all, everlasting Wisdom watching, loving and sustaining; happy we to get some glimpses of His method of working through the medium of the strange creatures which leave the mysterious deep to throw a new radiance on our homes.”



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